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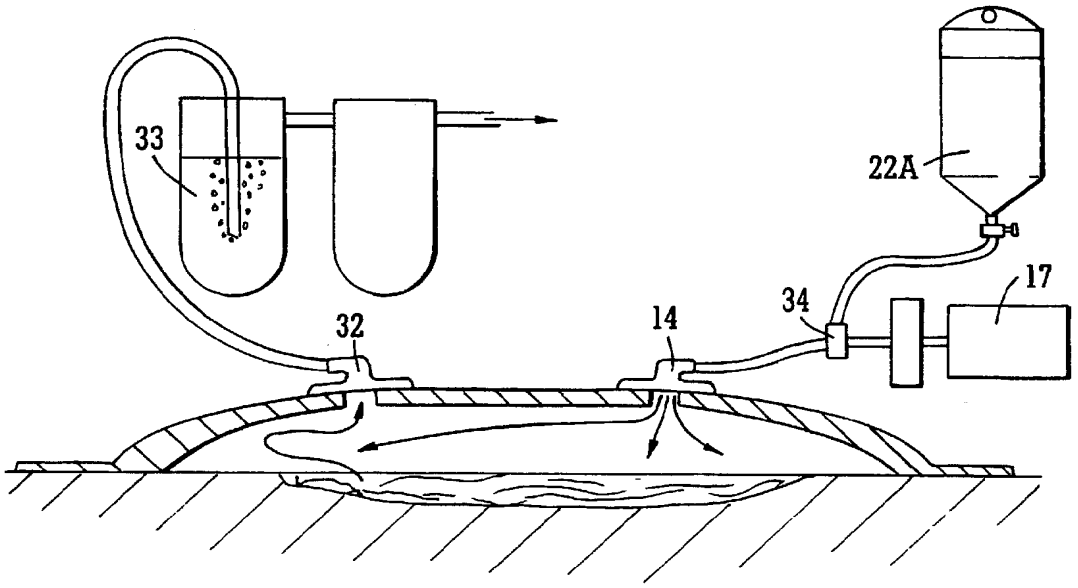
(54) Title: A VENTILATION APPARATUS



(57) Abstract: The present invention provides a ventilation apparatus (10) for ventilating a surface of a body, the ventilation apparatus being connectable to air flow producing means (40) via at least one inlet (14), the ventilation apparatus (10) including a surface locatable adjacent the surface of the body, the surface being provided with at least one outlet (13) through which air may pass such that the area of skin adjacent the surface can be ventilated.

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A VENTILATION APPARATUS

The present invention relates to a ventilation apparatus. In particular, the present invention relates to a ventilation apparatus which, in use, is locatable adjacent a surface of a body and can ventilate such surface.

Pressure care in the sick and elderly is usually managed by the use of low interface pressure devices, for example, alternating pressure and low air loss beds and seating. By supporting the body with low interface pressures such devices hinder the development of pressure sores, since they improve the blood flow in the support contact areas of the body by preventing the blood carrying capillaries from being closed off.

Another factor in pressure care is skin shear. Those involved with the care of the sick and the elderly will appreciate that skin tissue can be softened and weakened by excessive perspiration, and that such weakened skin tissue is particularly prone to damage where it is being supported on a bed support surface that is not mobile. They will also appreciate that the shear stresses exerted on the skin are exacerbated when a patient is located on a normal ward hospital bed, or an inadequate air flotation type bed, where the bed surface has no mobility and does not move when the patient moves. For example, when a patient shifts their position within such bed, usually with the aid of their elbows and heels, together with a twisting motion of the hips and upper torso, extra stress will be exerted on the already weakened skin tissue, especially if the sliding resistance of the patient's skin is high due to a build up of perspiration. This can also place or exert extra stress on the patient's elbows and heels.

According to the present invention there is provided a ventilation apparatus for ventilating a surface of a body, the ventilation apparatus being connectable to air flow producing means via at least one inlet, the ventilation

apparatus including a surface locatable adjacent the surface of the body, the surface being provided with at least one outlet through which air may pass such that the area of skin adjacent the surface can be ventilated.

It is believed that a ventilation apparatus in accordance with the present invention can assist with the pressure care of the sick and the elderly. In particular, and as a ventilation apparatus in accordance with the present invention can keep an area of skin dry, it is believed that same, with the aid of low interface pressures, aids skin tissue to withstand the stresses caused as a result of prolonged bed or chair confinement.

Additionally, due to the weight and pressure of a person exerted on existing support surfaces, the support medium and clothing is compressed to the point where nearly all the air is excluded thereby denying the skin surface the ability to perspire naturally, that is, without a build up of a high degree of humidity. Although vapour permeable materials are used as part of the support surface in many beds and seating systems, which enable a good degree of the moisture to be dispersed, there is still total exclusion of fresh air. In this connection, and as a ventilation apparatus in accordance with the present invention can ventilate an area of skin with fresh air, it is believed that same can assist with the healing of skin tissue and also, improve the general condition of skin tissue.

Furthermore, it will be appreciated that a ventilation apparatus in accordance with the present invention can create a controlled environment over an area of skin covered by same, which can be totally independent of ambient conditions. Such controlled environment is produced by the introduction of a lightly pressurised airflow, which is evenly distributed by the ventilation apparatus of the present invention. It is to be understood that, if desired, the temperature and humidity of the resultant airflow can be controlled and can even be suitably sanitised. Additionally, it is to be

understood that medicinal treatments can be introduced into the resultant airflow to treat wounds or infections.

Furthermore, a ventilation apparatus in accordance with the present invention can be used as a drying unit to keep wounds dry and to control the conditions in which bacteria thrive. That is, with most types of dressings, perspiration can be trapped between the dressing and the skin's surface thereby creating warm humid conditions in which bacteria thrive.

Additionally, as a ventilation apparatus in accordance with the present invention can create a comfortable perspiration free environment, same can be used to increase a person's comfort, especially in hot climates or conditions. Such an apparatus may be conducive to restful sleep and may assist with relieving any discomfort caused by hot flushes etc.

Non-limiting embodiments of a ventilation apparatus in accordance with the present invention will now be described by way of example, and with reference to the accompanying drawings, in which:

Fig. 1 is a cross sectional elevation through a first embodiment of a ventilation apparatus in accordance with the present invention;

Fig. 2 is a plan view of the ventilation apparatus of Fig. 1;

Fig. 3 is a cross sectional elevation of the ventilation apparatus of Fig. 1 when located underneath a person;

Fig. 4 is a side elevation of the ventilation apparatus of Fig. 1 when located on a bed;

Fig. 5 is a side elevation of the ventilation apparatus of Fig. 1 when located on a seat and also illustrates a second embodiment of a ventilation apparatus in accordance with the present invention which is suitable for use a wound dressing;

Fig. 6 is a side elevation of a second embodiment of a ventilation apparatus suitable for use as a wound dressing;

Fig. 7 is plan view of the ventilation apparatus of Fig. 6;

Fig. 8 is a plan view of a third embodiment of a ventilation apparatus in accordance with the present invention suitable for use as a wound dressing; and

Fig. 9 is a schematic illustration of a control system suitable for use with a ventilation apparatus in accordance with the present invention.

As illustrated in Fig. 1, a first embodiment of a ventilation apparatus 10 in accordance with the present invention is preferably made from several layers of a fabrics or plastics material, and includes a base sheet of waterproof or vapour permeable material 11.

Additionally, the ventilation apparatus 10 includes an air distribution matrix or portion 12, preferably formed from two sheets of air proof or airtight material which form a cavity. Such air distribution matrix 12 is provided with air holes or apertures 13 extending through the upper surface thereof.

A tube 14 extends from the air distribution matrix 12, such tube 14, in use, being connectable to means for producing an airflow, for example, an air pump 40.

A sheet of space creating material 15 is located immediately above the air distribution matrix or air distribution portion 12. In use, such space creating material 15 partially supports the weight of a person's body by virtue of its resilience and resistance to crushing. Preferably, such space creating material 15 consists of a non-woven material, or of a moulded or extruded plastic type mesh.

The ventilation apparatus 10 further includes a comfort layer of fabric 16, preferably of open mesh, which, in use, assists with the absorption of perspiration and also enables air to pass freely therethrough.

As illustrated in Fig. 2, the apertures 13 are preferably located in the central portion of the ventilation apparatus 10 such that the air forced out through the apertures 13, will generally flow radially outwards in direction X towards the sides of the ventilation apparatus 10.

With reference to Fig. 3, when a ventilation apparatus 10 in accordance with the present invention is located beneath a person 100, it will be appreciated that the impervious base material and the person 100 form a lower and upper air barrier respectively, such that a continuous and even fresh air stream can flow outwardly in the interface between the person 100 and the surface of the ventilation apparatus 10 adjacent the surface of the person's body.

In an unillustrated embodiment, the apertures 13 may include valves that release air only when the valves are compressed and opened by the weight of the person 100 located or resting against the ventilation apparatus 10.

Additionally, where incontinence may be encountered, it is to be understood that disposable materials may be used.

With reference to Fig. 4, a ventilation apparatus 10 in accordance with the present invention when located on a bed 30, can be connected to a control unit or system 17 via tube or air supply pipe 14. It is to be understood that the control system 17 can be a very simple manual system or a fully automatic system with varying degrees of automation. It is also to be understood that same can be incorporated into any of the control systems of any other apparatus with which the ventilation apparatus 10 may be associated.

The control system 17 preferably includes the air pump 40, an electronic control panel or pad, a set of changeover valves and a humidity

detector or sensor 18. Preferably, the air pump will be able to draw a vacuum, as well as be able to deliver a positive pressured air supply via the air supply pipe 14.

When the control system 17 is set to automatic, the air pump 40 will start after a timed period. At the same time, the changeover valves will be switched on for a very short period to a sampling cycle such that a small sample of air will be drawn through the ventilation apparatus 10, that is, via apertures 13. This sample of air is passed over the humidity detector 18 such that the humidity level therein can be analysed. If the sample is normal, that is, if the level of humidity is deemed acceptable, then the system will go into a dormant monitoring cycle of timed intervals between sample analysis on a continuous basis. If the level of humidity is deemed unacceptable, then the control system changes over to the valve system, and fresh air, or treated air, from the pump 40 is fed through the air supply pipe 14 to the ventilation apparatus 10. The air is distributed through the apertures 13 in the matrix 12 and is forced through the spacer material 15 thereby reducing the level of humidity and perspiration, i.e. adjusting the climatic conditions between the person 100 and the surface of the ventilation apparatus 10 supporting same. After a predetermined time period, the sampling cycle described above tests the humidity level once again and the automatic cycle continues.

It is to be understood that the control system 17 can also be used in manual operation wherein a constant flow of cooling or warm air is required, for example, where the ventilation apparatus 10 is being used purely for comfort reasons or for specialised treatments.

As an aid to understanding the machinations of a control system 17 suitable for use with a ventilation apparatus 10 in accordance with the present invention, a non-limiting example of how same can control the supply of air, treated or otherwise, to the ventilation apparatus 10 will now be described with reference to Fig. 9.

When the ventilation apparatus 10 is connected to a power supply, the control system 17 is set to automatic mode as default.

Automatic mode.

During automatic mode, a continuous time cycle, having a period of 15 minutes, commences. Such continuous time cycle has the following steps:

Step 1: At the beginning of the 15 minute cycle, the air pump 40 is actuated and runs for a first "sampling" period of 20 seconds. At the same time solenoid S2 is energised, and the humidity sensor 18 is activated.

Step 2.1: After 20 seconds has passed, the solenoid S2 is de-energised or deactivated.

Step 2.3: If the humidity level read by the humidity sensor 18 is deemed acceptable then the pump 40 stops and the humidity sensor 18 is de-activated and the 15 minute time cycle continues, that is, until such time as the 15 minute time period has expired and the cycle starts all over again starting at step 1.

Step 2.4: If however the level of humidity is deemed unacceptable i.e. is above a set or predetermined point, then the pump 40 continues to run for the full 15 minute cycle. Simultaneously, the solenoid S2 de-energises and solenoid S1 energises for the remainder of the 15-minute continuous time cycle. At the end of the 15 minute cycle period, the cycle will start all over again, that is, with step 1.

When set to run on automatic mode, manual inflate buttons provided on the control panel or pad override and de-energise solenoid S1, such that on release, solenoid S1 re-energises and the automatic cycle continues.

Manual mode.

The control system 17 also preferably includes an override button provided on the hand controller or control pad, which when depressed, overrides the default setting, identified as automatic mode and outlined above.

When overridden, solenoid S1 is energised, and the pump 40 runs continuously until the override button is depressed again, such depression of the override button resulting in the de-energisation or deactivation of solenoid S1 and the pump 40. On deactivation, the control system 17 reverts automatically to its default setting, namely, the mode identified as automatic mode above.

In a preferred embodiment, the control system 17 can also regulate the air flow to different regions of the ventilation apparatus 10 that is, via different air supply pipes 14 and hence vary the pressure at different points along same, for example, see Figure 4. As will be appreciated, this enables the pressures exerted by the ventilation apparatus 10 to be varied against different parts of a user's body 100. For example, and as shown in Fig. 9, pressure near the user's head can be increased by depressing a first control button on the control pad (not illustrated) which actuates solenoid S3, which starts the pump 40, that is, if same it is not already running. Whilst depressed, solenoid S3 will remain energised and the pump 40 will continue to run for a timed 5-minute period after the first control button is released. Pressure adjacent the mid zone of a user can be varied by depressing a second control button (not illustrated) on the control pad which actuates solenoid S4, which starts the pump 40, that is, if same it is not already running. Whilst depressed, solenoid S4 will remain energised and the pump 40 will continue to run for a timed 5-minute period after the second control button is released. Pressure adjacent the feet or foot of a user can be varied by depressing a third control button (not illustrated) on the control pad which actuates solenoid S5, which starts the pump 40, that is, if same it is not

already running. Whilst depressed, solenoid S5 will remain energised and the pump 40 will continue to run for a timed 5-minute period after the third control button is released. In order to reduce the pressure exerted adjacent the user's head i.e. adjacent the head zone, a fourth control button (not illustrated) on the control pad is depressed, thereby actuating solenoid S6. Once released, solenoid S6 is deactivated. Likewise, in order to reduce the pressure exerted adjacent the mid zone of the user a fifth control button (not illustrated) on the control pad is depressed, thereby actuating solenoid S7. Once released, solenoid S7 is deactivated. Likewise, in order to reduce the pressure exerted adjacent the foot or feet of a user a sixth control button (not illustrated) on the control pad is depressed, thereby actuating solenoid S8. Once released, solenoid S8 is deactivated.

It will thus be appreciated that a ventilation apparatus in accordance with the present invention can also be used to treat pressure sores at an advanced level or other wounds such as ulcers, burns, etc., that is, by locating same adjacent such skin condition.

Additionally, and as shown in Figs. 5-8, a ventilation apparatus 10 in accordance with the present invention can act as a dressing that is locatable over a wound. Preferably, the ventilation apparatus 10 is provided with a self-adhesive, which may be applied continuously around the perimeter of the dressing 10 (see Fig. 7) or intermittently around the perimeter of the dressing 10 (see Fig. 8).

A ventilation apparatus 10 used as a dressing can be connected to a suitably filtered, sanitised and treated airflow, and can act as a stand-alone system. It is to be understood that the climatic conditions within the wound area can be adjusted to give optimum healing and relief.

As illustrated in Fig. 8, a ventilation apparatus 10 suitable for use as a standard dressing is provided with gaps 31 around its perimeter. As outlined

above such gaps are provided due to the intermittent application of the self-adhesive, which enables same to be attached to a person's body 100. Such gaps 31 allow air to escape to the atmosphere after ventilating the wound.

As illustrated in Figs. 6 and 7, in the case of virulent infections, where air/gas would not be allowed to escape to the atmosphere, the ventilation apparatus 10 is further provided with an exhaust or outlet pipe 32 such that air exiting same can be safely dealt with to prevent airborne infection from spreading. In this connection, the air exiting outlet 32 may be passed through a filter system 33. Additionally, the dressing 10 and disposable filters could be incinerated after use.

It is believed that further flexibility in the treatment regimes may be obtained by drawing air through the ventilation apparatus 10 by reducing the pressure of the exhaust to below ambient pressure. By doing so, the ventilating air is drawn through the dressing and the medication is introduced through free-flowing air via the filtration and medication dosage unit 34 from the inlet side, that is, via pipe 14.

As illustrated in Fig. 5, a ventilation apparatus 10 when acting as a wound dressing can be coupled to a filtration unit 21 and a medication dosage unit 22. It is to be understood that the latter may also be in the form of a familiar drip feed bag system 22A. It will be appreciated that by utilising a ventilation apparatus in accordance with the present invention as a wound dressing that the conditions within the confines of the ventilation apparatus can be adjusted to give exactly the ideal climatic conditions for healing. Additionally, it will be appreciated that the ventilation apparatus 10 can be used to deliver suitable drugs to the wound site, or site of infection, as well as deliver a fine frugal mist of anaesthesia thereby providing instantaneous and continuous relief for painful conditions such as burns.

Furthermore, and due to the fact that positive pressure within the ventilation apparatus 10 is built up by the airflow, it will be appreciated that the ingress of bacteria and other infectious agents can be resisted.

Ozone is known to have particular application as a sterilisation/disinfection agent and has the ability to kill or exterminate almost every known type of bacteria including MRSA, E.Coli, C.albicans, Str.viridans etc. Consequently, a preferred embodiment of a ventilation apparatus in accordance with the present invention further includes an ozone generator, preferably located between the air supply pump unit 40 and the ventilation apparatus 10. Preferably, ozone is generated with full output when the unit is switched on and variations in output level can be achieved by pulsing the generator in a proportional on/off cycle. For example, for a low level requirement of ozone, the generator might be switched on for one second and off for nine seconds, that is, during a ten second cycle. Furthermore, it is preferable that a mixing chamber (not illustrated) is provided in the supply line after the generator. This has the beneficial effect of ensuring that a steady proportional mix of ozone and air/gas is delivered to the wound site.

Preferably, the supply system from the ozone generator will have various input points which will include the ability to drip feed, such that, and as previously described, a mist of ozonated fluid can be delivered to the wound site.

It is also to be understood that the ozone could be passed through the drip feed bag system 22A, such that ozonated water can be introduced into the air flow entering the ventilation apparatus via pipe or inlet 14. In this embodiment, it is preferable that the drip feed bag 22A includes distilled water through which the ozone is passed.

It is believed that this preferred embodiment can also be used to assist with the treatment of asthma. That is, it is also well known that asthma and

other respiratory complaints are caused by the activities of bed mites and other such organisms. As will be appreciated, such organisms are very difficult to dispose of and therefore, can cause distress to sufferers of such complaints. In this connection, it has been established that ozone in sufficient density and exposure will kill these organisms. Therefore, it will be understood that a ventilation apparatus 10 in accordance with the present invention can also act as an air proof, neatly fitting cover which can fit over a mattress and/or bed clothes, i.e. can act as a sterilisation hood to all beds. Such is arranged to deliver a suitable concentration and flow of ozone, preferably controlled as an automatic cycle by a controller system including safety alarms etc.

It is to be understood that a ventilation apparatus in accordance with the present invention can be used to encase limbs, or complete bodies in garments and can supply air or other gases, and can be used for other treatment and temperature control.

It is also to be understood that a ventilation apparatus in accordance with the present invention can be incorporated into seats of all types, for example, vehicle seats and theatre seats, to increase the comfort of same. In particular, and as a ventilation apparatus in accordance with the present invention can produce a very low level of air conditioning, it will be appreciated that same can provide a very comfortable personal feel. Additionally, and as each ventilation apparatus can be provided with individual controls, it will be appreciated that same provides extreme flexibility and may be more economical. In this connection, it is believed that by providing each seat in an auditorium or like venue with a ventilation apparatus in accordance with the present invention, which can be heated or cooled independently, can reduce the auditorium's heating or cooling costs. That is, since the feelings of thermal discomfort are first felt through the seat, for example, on a hot day the contact area with the seat becomes hot and sticky, and on a cold day clothing in the seat and back area becomes crushed and compressed excluding the

thermal insulation air barrier of the clothing worn, and lowering its normal insulation value, it is believed that a small volume of slightly cooled or warmed air introduced through a ventilation apparatus in accordance with the present invention would have a very large effect for a relatively small input of energy.

It is also to be understood that a ventilation apparatus in accordance with the present invention can be used independently with any bed or seat or any other body supporting structure or alternatively, be incorporated as an integral part of any bed or seat or any other body supporting structure, which includes any existing pressure beds, or air flotation systems. It is also to be understood that a ventilation apparatus can be incorporated into, or associated with, a duvet or pillow or any other article that will come into contact with a person's body.

CLAIMS

1. A ventilation apparatus for ventilating a surface of a body, the ventilation apparatus being connectable to air flow producing means via at least one inlet, the ventilation apparatus including a surface locatable adjacent the surface of the body, the surface being provided with at least one outlet through which air may pass such that the area of skin adjacent the surface can be ventilated.

2. A ventilation apparatus of claim 1, wherein the at least one outlet is located along a central portion of the surface of the ventilation apparatus.

3. A ventilation apparatus as claimed in claim 1 or 2, wherein the at least one outlet is further provided with a valve.

4. A ventilation apparatus as claimed in any one of the preceding claims, wherein the ventilation apparatus further includes an ozone generator.

5. A ventilation apparatus as claimed in claim 4, wherein the ventilation apparatus further includes a mixing chamber such that a mix of ozone and air can be produced before passing through the at least one outlet.

6. A ventilation apparatus as claimed in any one of the preceding claims, wherein the ventilation apparatus further includes means for introducing medicaments into the air to be passed through the at least one outlet.

7. A ventilation apparatus as claimed in any one of the preceding claims, wherein the ventilation apparatus further includes at least one second outlet through which the ventilation air located between the surface of the body and the surface of the ventilation apparatus can be removed.

8. A ventilation apparatus as claimed in claim 7, wherein the ventilation apparatus further includes means for treating the air once it has exited the second outlet.

9. A ventilation apparatus as claimed in any one of the preceding claims, wherein the ventilation apparatus includes filter means which, in use, filters the air passing through the at least one inlet.

10 A ventilation apparatus as claimed in any one of the preceding claims, wherein the ventilation apparatus further includes means for controlling the flow of air into the ventilation apparatus.

11. A ventilation apparatus as claimed in claim 11, wherein the control means includes a humidity sensor, and the airflow producing means are actuated depending on the readings taken by the humidity sensor.

12. A ventilation apparatus as claimed in any one of the preceding claims, wherein the ventilation apparatus is associated with the mattress of a bed.

13. A ventilation apparatus as claimed in claim 12, wherein the control system includes means for regulating the flow of air to different parts of the body when located on top of the mattress.

14. A ventilation apparatus as claimed in any one of claims 1 to 11, wherein the ventilation apparatus is associated with a wound dressing.

15. A ventilation apparatus which, in use, can ventilate a surface of a body, the ventilation apparatus being connectable to air flow producing means via at least one inlet, the ventilation apparatus including a surface locatable adjacent the surface of the body, the surface being provided with at least one outlet through which air may pass such that the area of skin adjacent the surface can be ventilated.

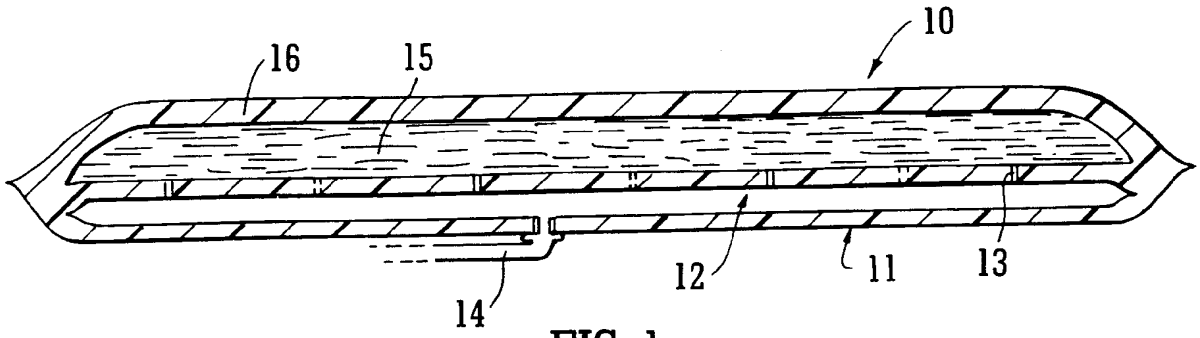

FIG. 1

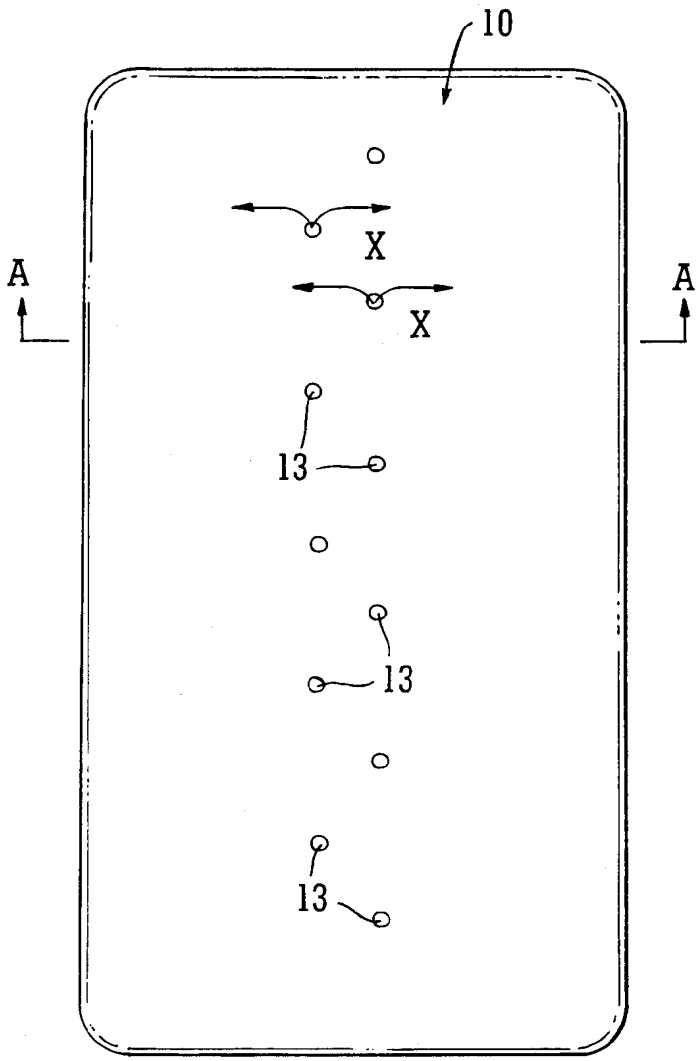

FIG. 2

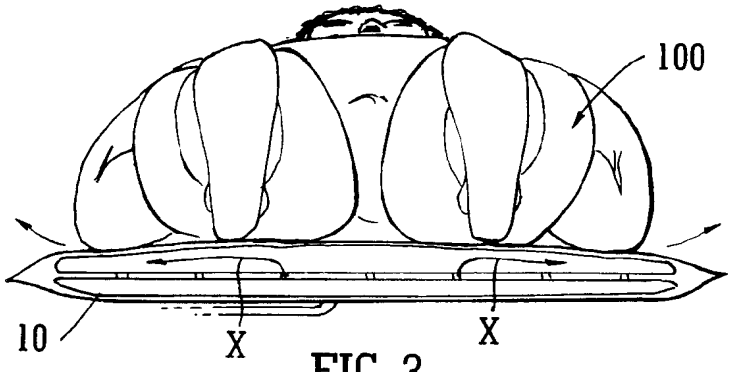

FIG. 3

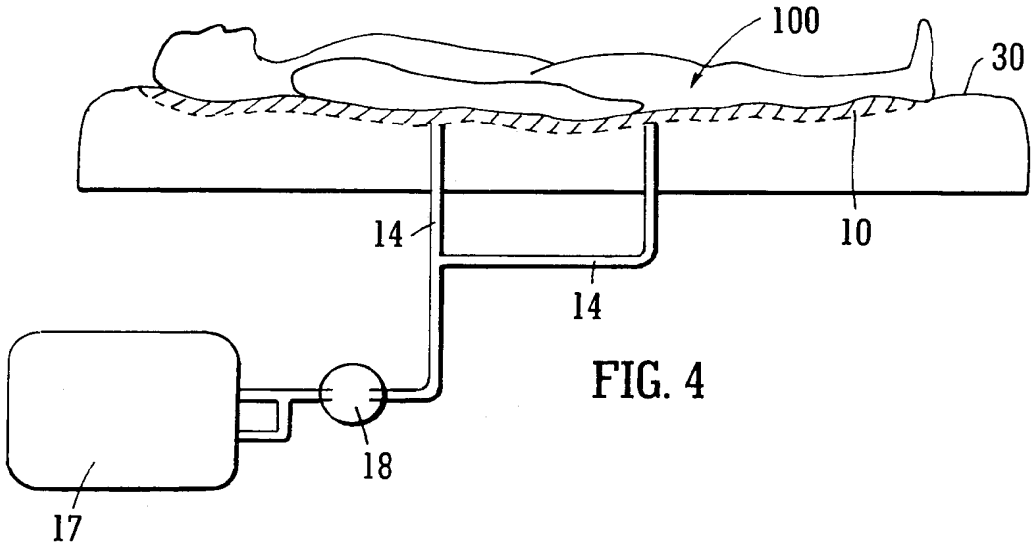

FIG. 4

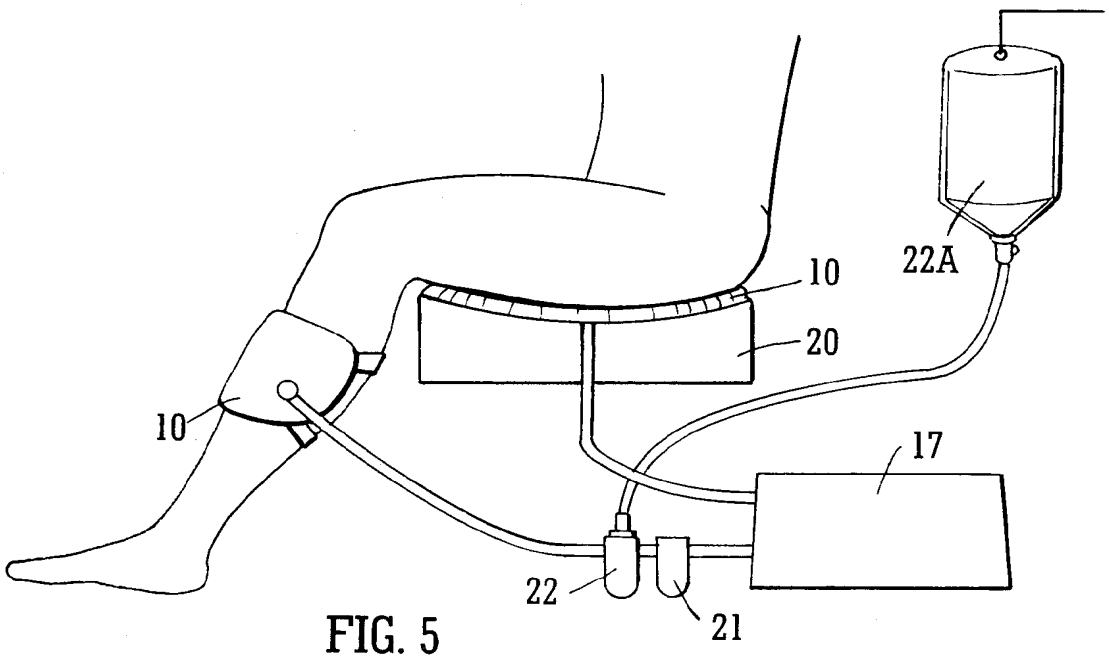

FIG. 5

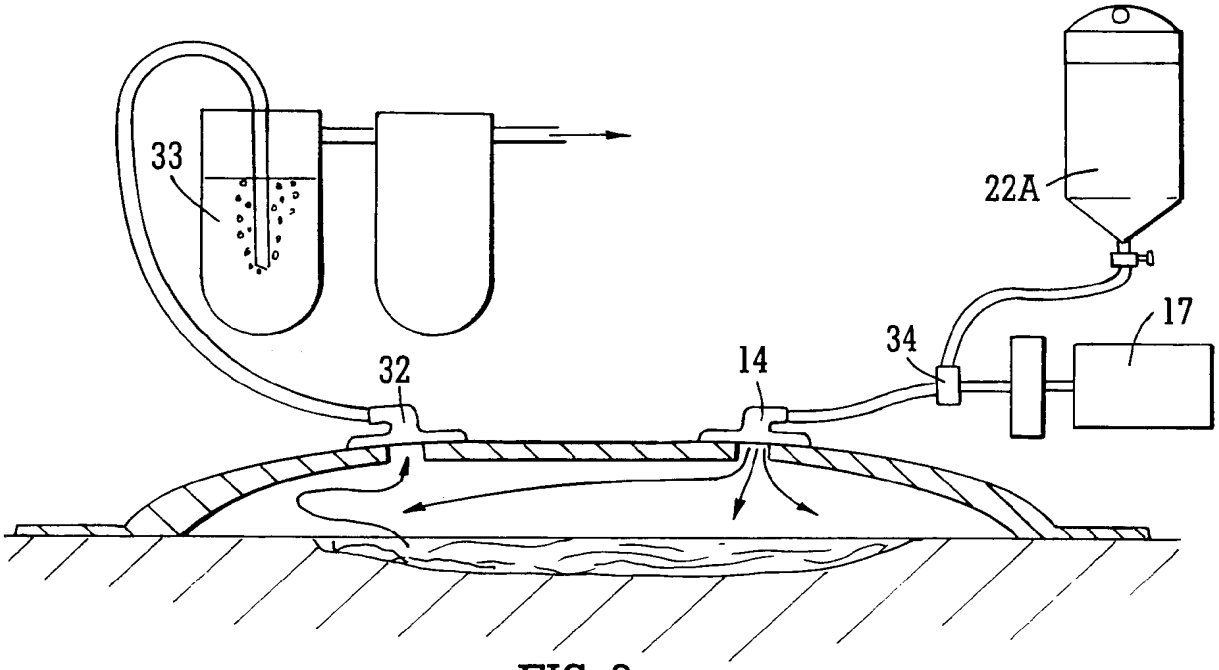

FIG. 6

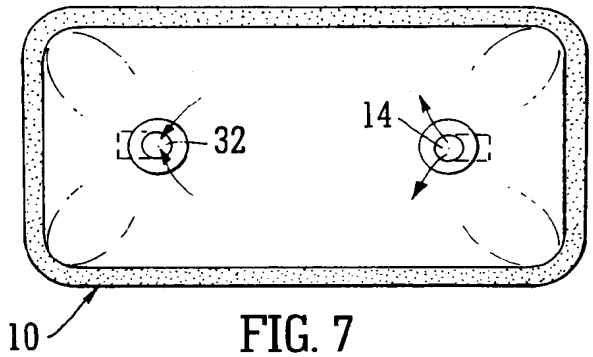

FIG. 7

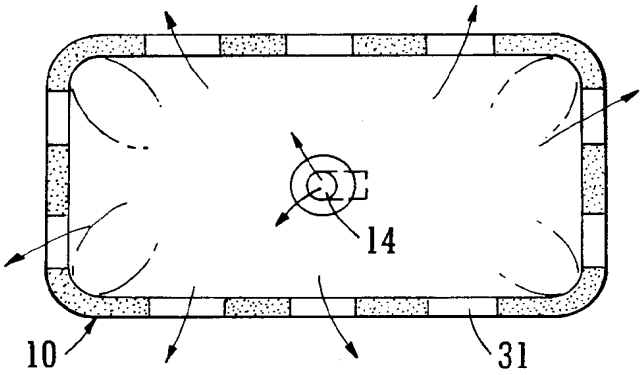

FIG. 8

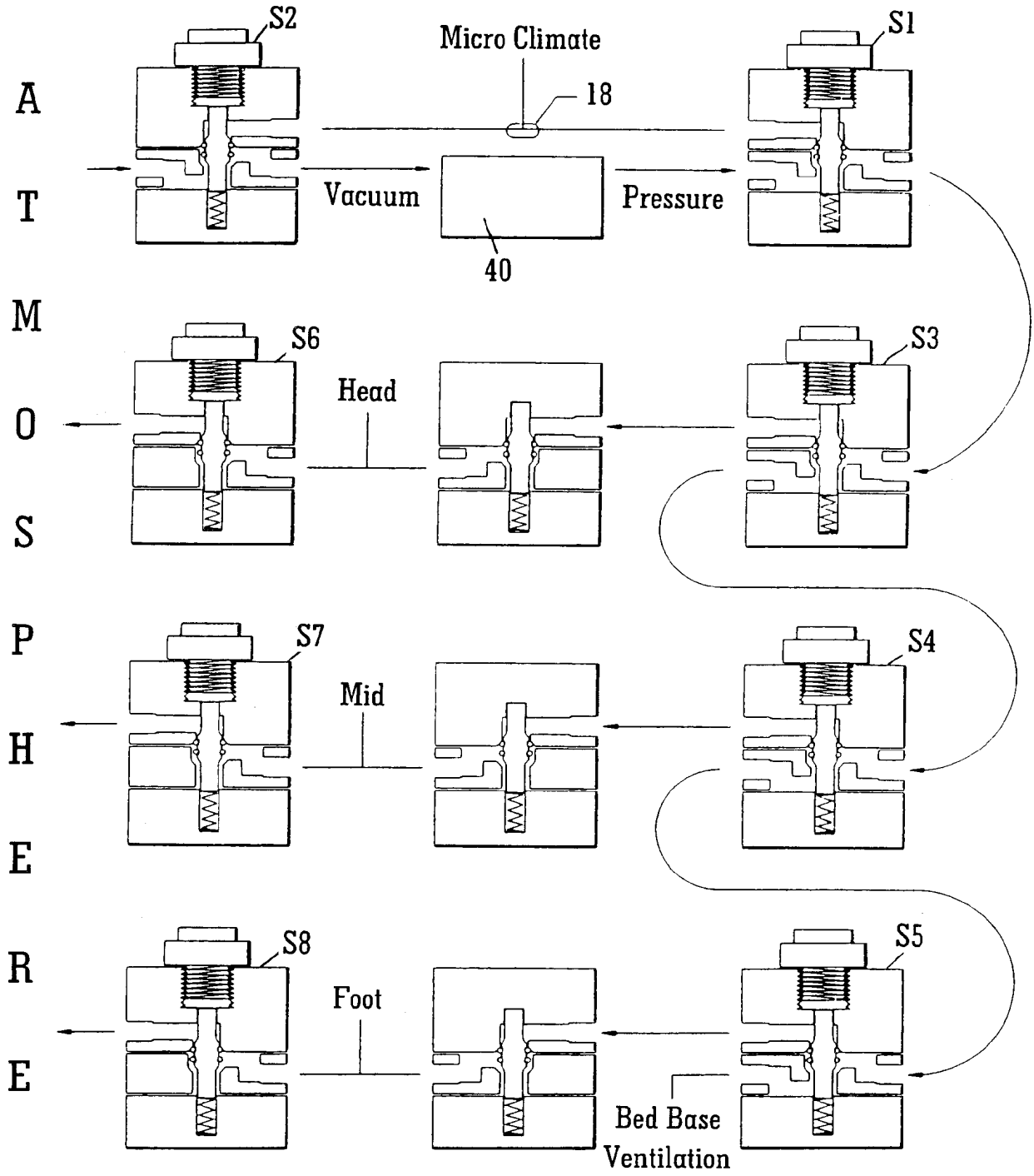
S2
Micro Climate
S1
A
18
T
Vacuum
Pressure
40
M
S6
Head
S3
O
S
P
S7
Mid
S4
H
E
S8
Foot
S5
R
E
Bed Base
Ventilation

FIG. 9

INTERNATIONAL SEARCH REPORT

Interr ıal Application No
PCT/GB 00/04477

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61G7/057

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61G A61M A61F A61B A47C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 31309 A (AUGUSTINE MEDICAL INC ;AUGUSTINE SCOTT D (US)) 23 July 1998 (1998-07-23) page 14, line 16 - line 19 page 23, line 6 - line 11; figure 19 ---	1,4-11, 14,15
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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24 January 2001	31/01/2001

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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